Lower ToF Thermal Analysis and Test

M. Cova

ToF Requirements

- Operative Temperature Range

  [-30°C;+50°C]

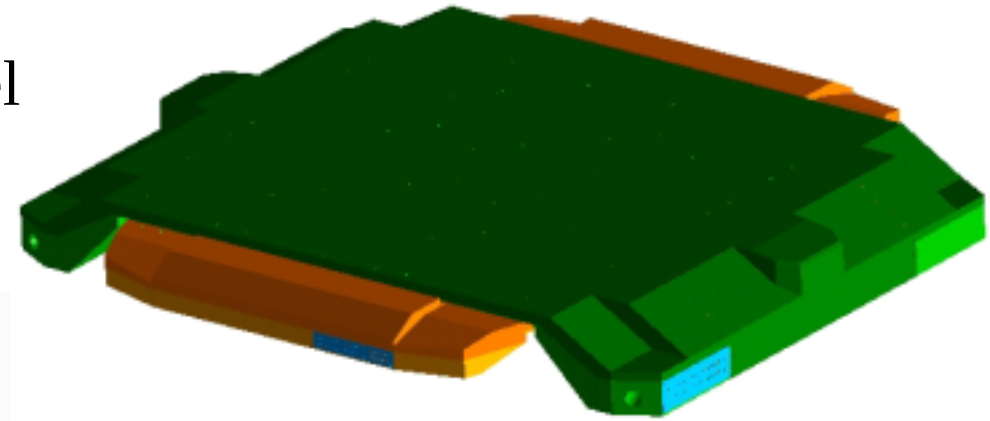
- Non Operative Temperature Range

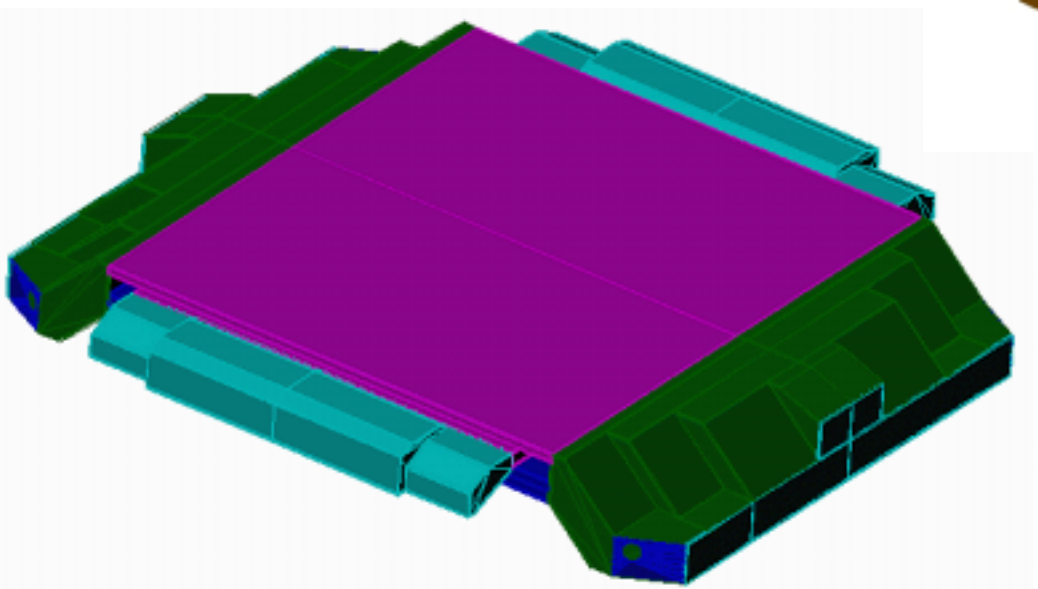
  [-40°C;+60°C]

  [-30°C;+50°C] non op. range has been updated by test results

ToF Thermal model

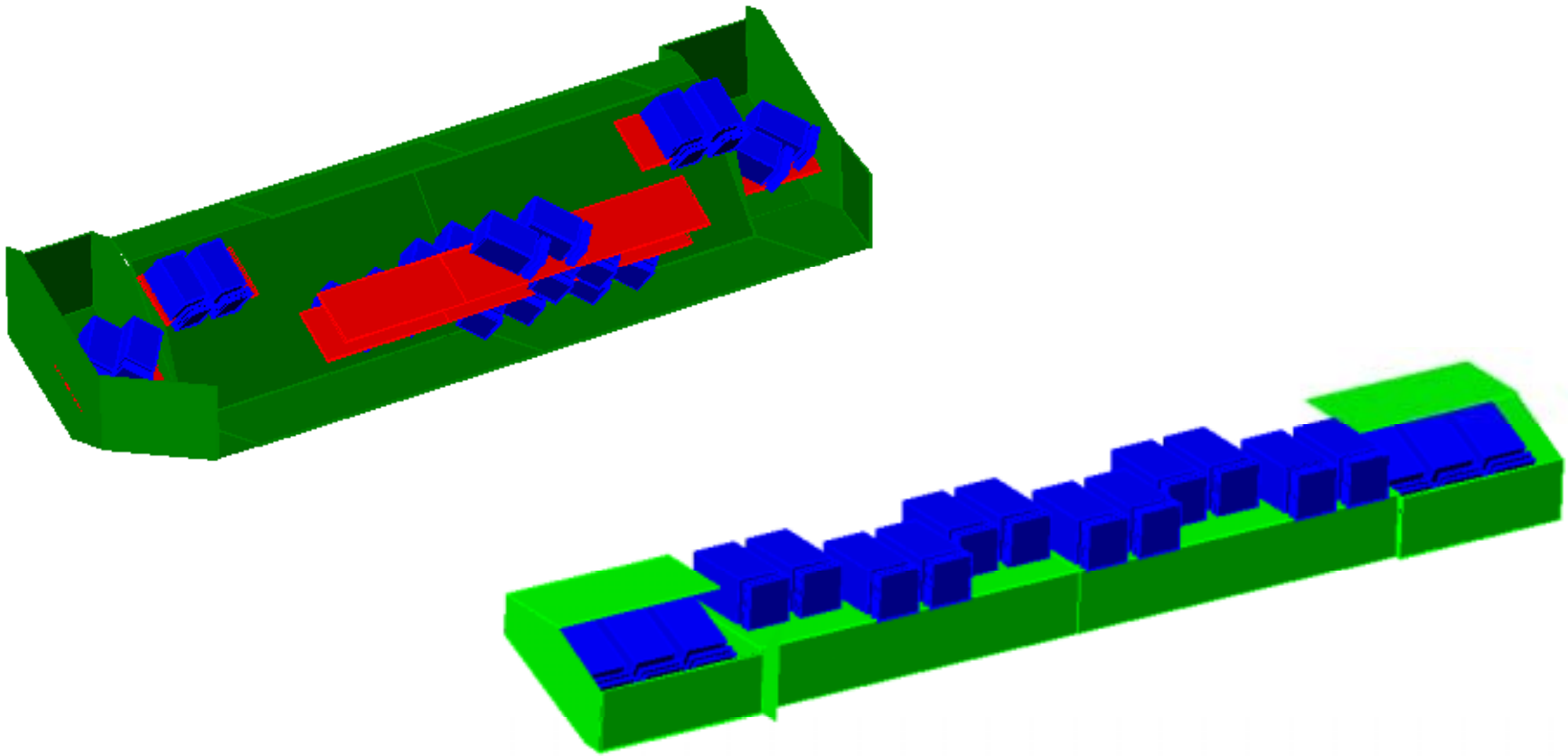
CAD Model





GMM Model

ToF Thermal model



Thermal Control Concept

Due the low dissipation of the Tof (3.68W) a radiator is not the most effective solution.

The percentage of the TOF bulk dissipation is little if compared with the external impinging heat fluxes.

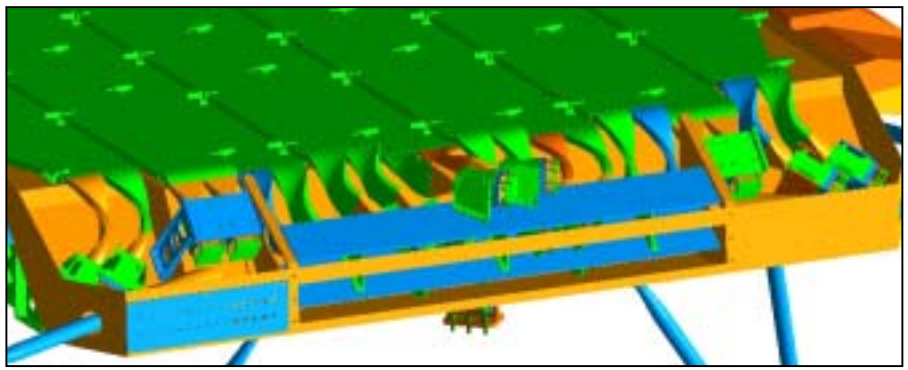
For this reason the temperature of a potential radiator shall not be driven by the inside coming dissipation but mostly from the external natural and induced environment.

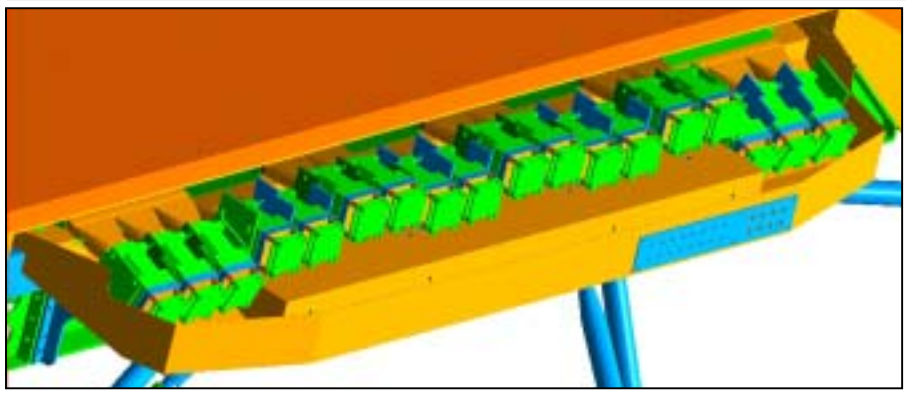
→ Detector completely covered by MLI.

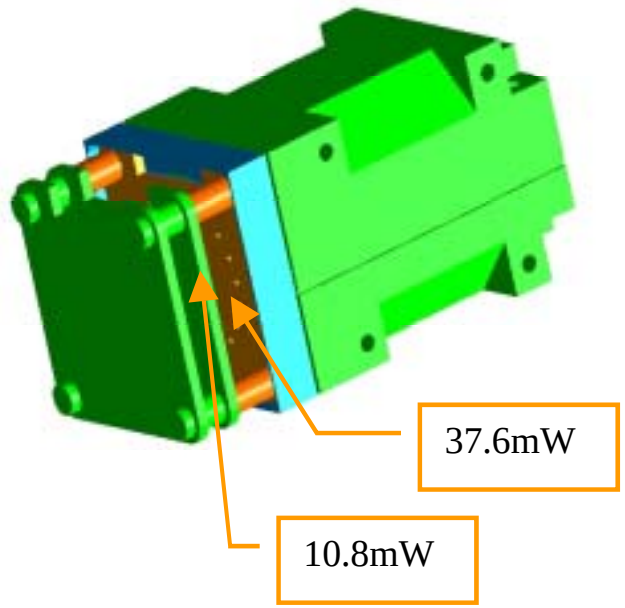
The heat leakage through the layers is of the same order of the TOF bulk dissipation

ToF dissipation

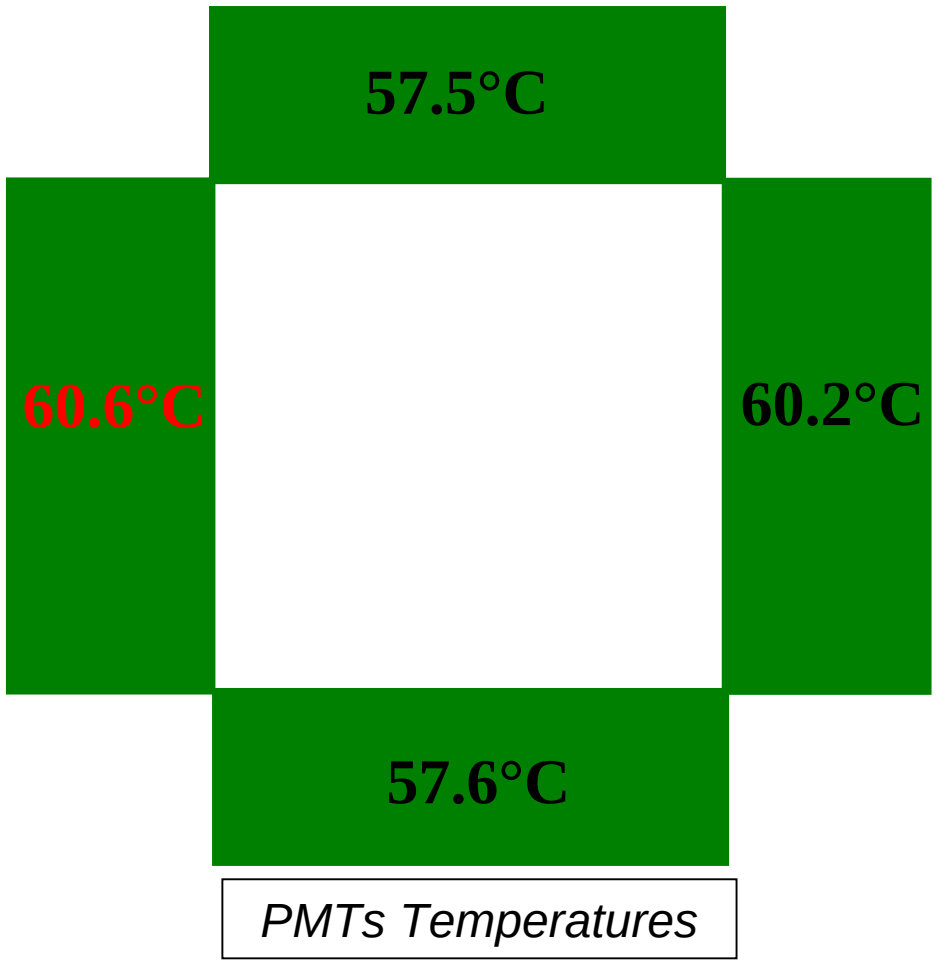
PMTs = 48.4 mW x 76= 3.68W







Thermal Analysis Results
-Hot cases-

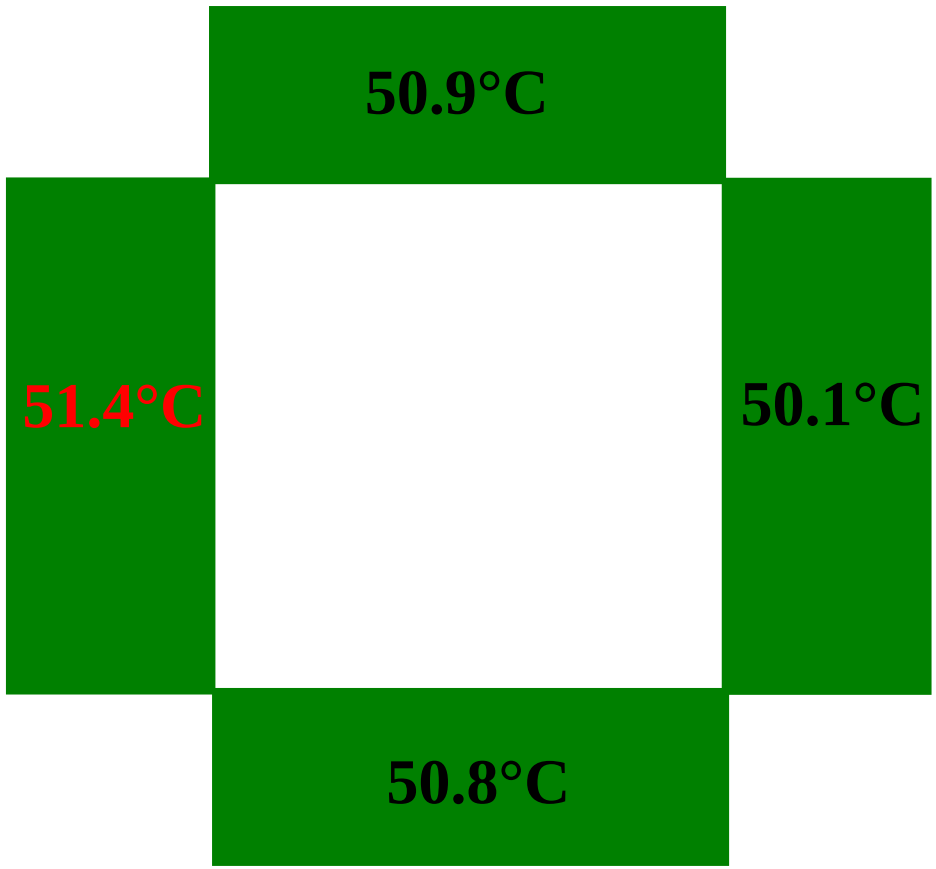


PMTs Temperatures

HOT cases

B-75_MPA_hot
Operative

60.6°C is the maximum PMT temperature prediction

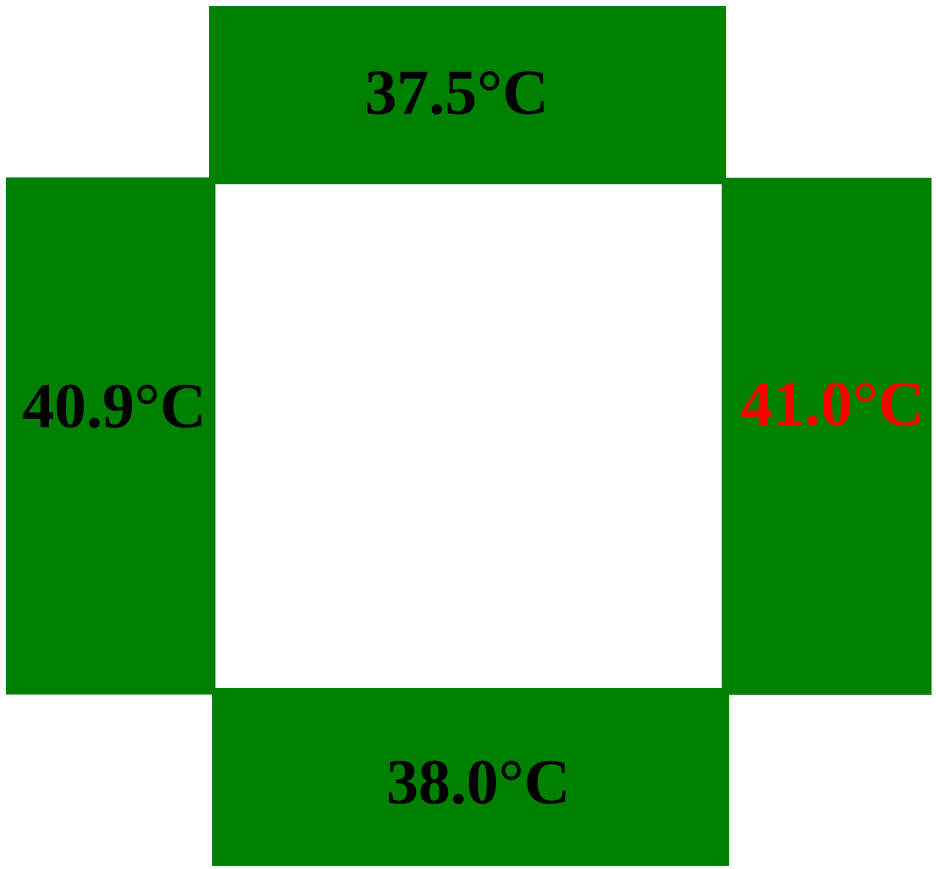


PMTs Temperatures

HOT cases

B-75_MPA_hot
Non Operative

51.4°C is the maximum PMT temperature prediction



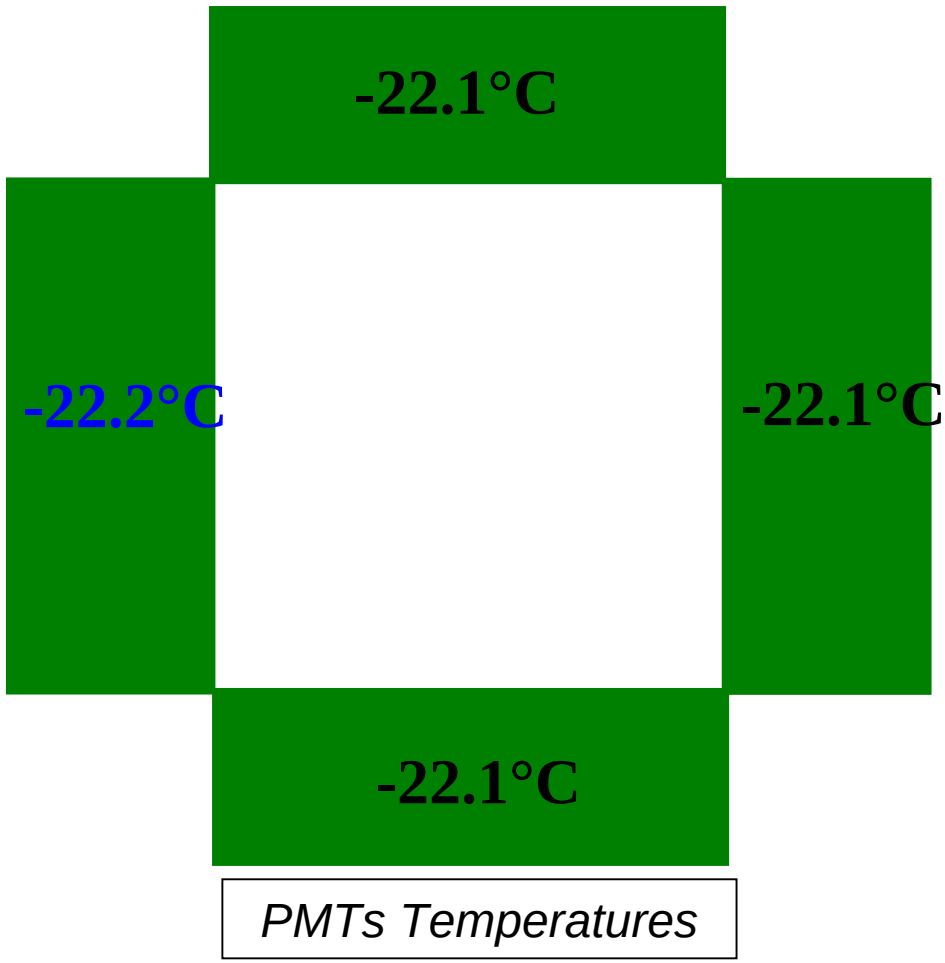
PMTs Temperatures

HOT cases

B-60_MPA_hot
Operative

41.0°C is the maximum PMT temperature prediction (9°C margin)

Thermal Analysis Results
-Cold cases-

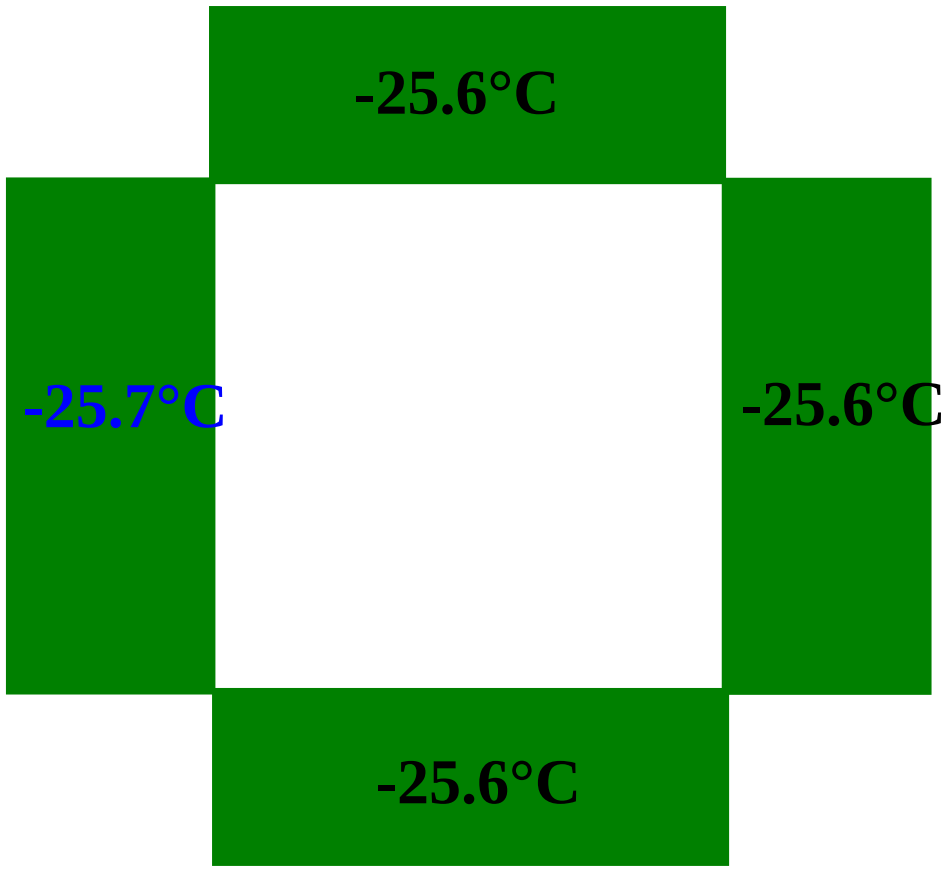


PMTs Temperatures

COLD cases

B_0_MPA_cold
Non Operative

-22.2°C is the minimum PMT temperature prediction (7.8°C margin)



PMTs Temperatures

COLD cases

B_0_0_0-15_cold
Non Operative

-25.7°C is the minimum PMT temperature prediction (4.3°C margin)

Conclusions

HOT cases

The detector in the MPA attitude works for

$$-60° \leq \beta \leq +75°$$

and so it is ON for the 95% of time.

Test campaigns has been done for non operative cases:

– 10 PMTs at +60°C for 1 week → positive results

→ No problem when ToF is OFF

Conclusions

COLD cases

Test campaigns has been done for non operative case:

– 10 PMTs at –40°C for 1 week → positive results

No heaters needed

Conclusions

- Test campaign will be done for operative cases:
  - 10 PMTs at +55°C